

CLIMATE SERVICES FOR ENERGY

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EUPORIAS




OUTLINE:

An orange arrow pointing to the right, highlighting the first item in the outline.

1. OVERVIEW OF CLIMATE SERVICES FOR ENERGY

2. CLIMATE SERVICES PROJECTS

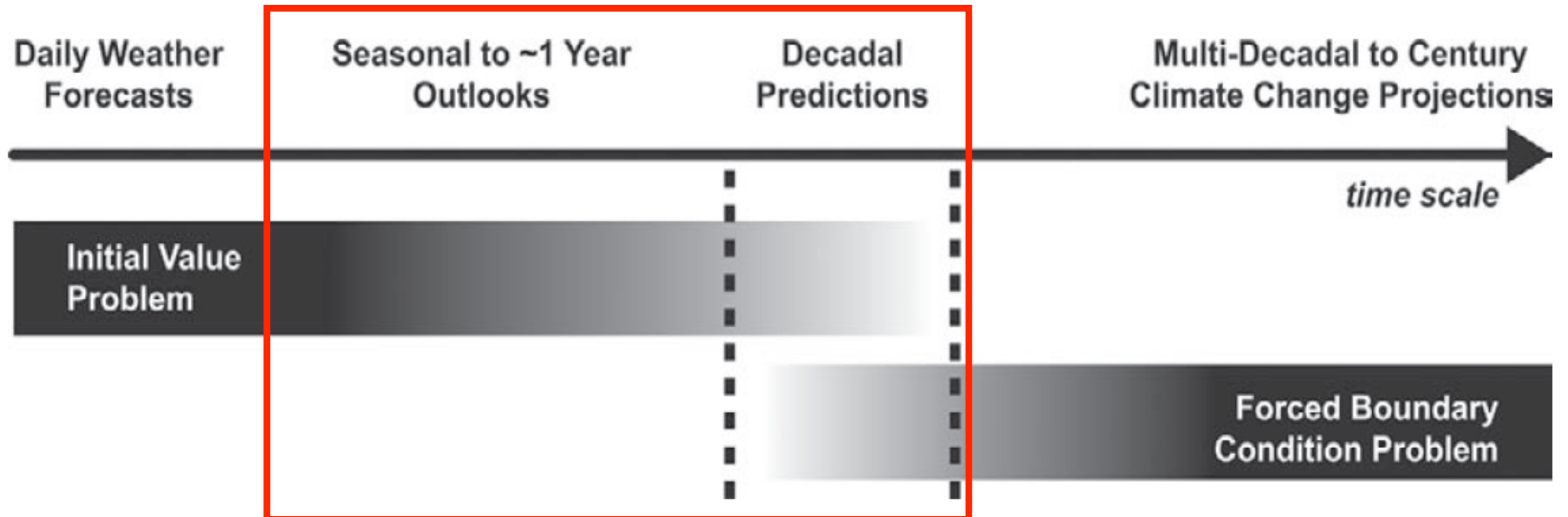


“[Renewable] energy provision may be anticipated, not only in the short and long term as it is today, but also at intermediate horizons, where a huge market niche appears.”

Ignacio Lainez Aracama, Professor of Wind Energy, EOI and Director of Energy Assessments, EDP Renewables. El País Article: 4th March 2014: Mix energético: las renovables y su predictibilidad

Time Scale Horizons

- Initial-value problems (weather forecasting) to forced boundary condition problem (climate projections)
- **Climate forecasts** (sub-seasonal, seasonal and decadal) in the middle



WHY Climate Services?

Anticipate and Identify Vulnerabilities and Risks

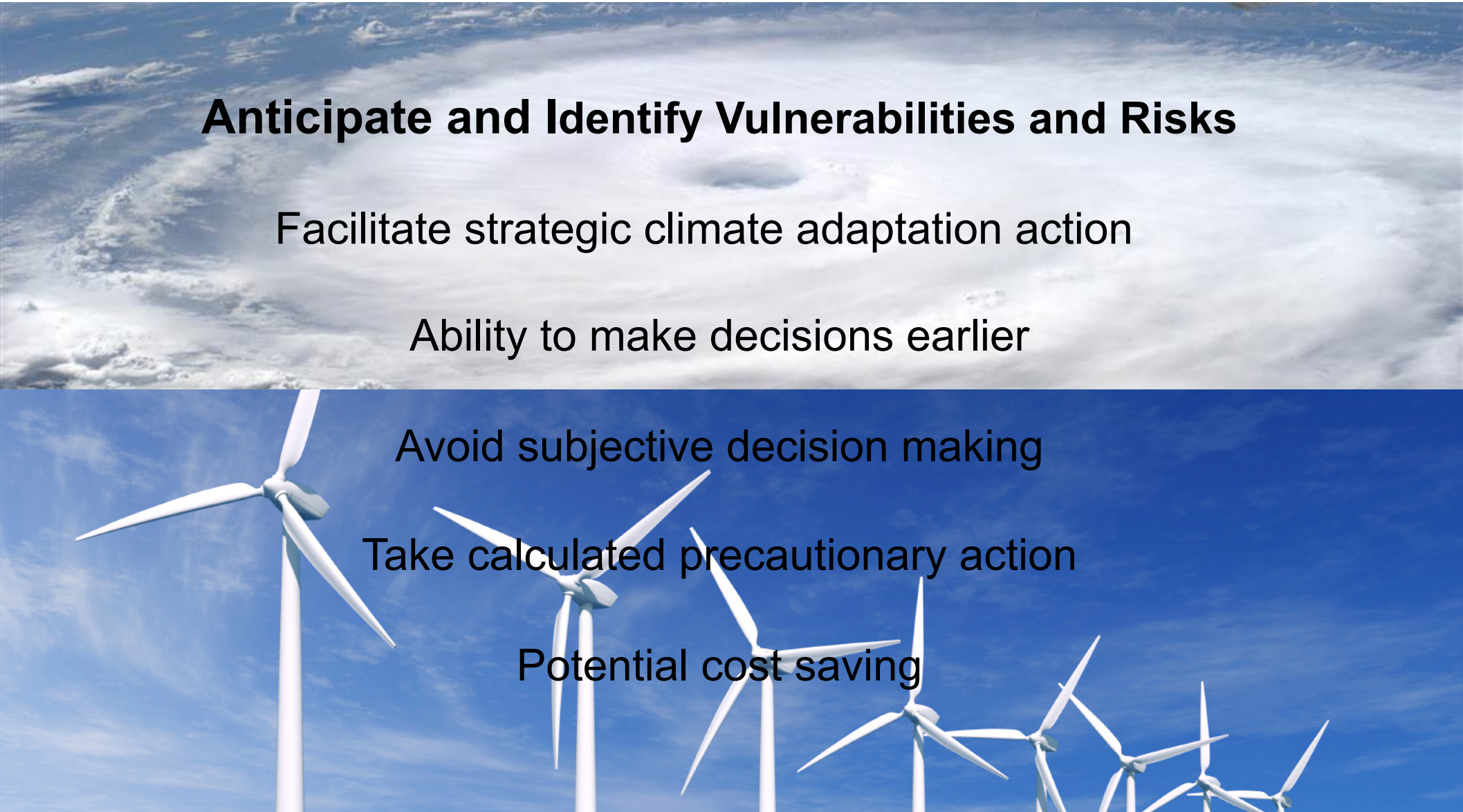
Facilitate strategic climate adaptation action

Ability to make decisions earlier

Avoid subjective decision making

Take calculated precautionary action

Potential cost saving





Pre-Constuction Decisions: Annual to Decadal Timescales

Wind farm planners: Site selection

Wind farm investors: Evaluate return on investments

Policy makers: Understand changes to energy mix



Post-Construction Decisions: Monthly to Seasonal Timescales

Energy producers: Resource management strategies

Energy traders: Resource effects on markets

Wind farm operators: Planning for maintenance works

Wind farm investors: Optimise return on investments

OUTLINE:

1. OVERVIEW OF CLIMATE SERVICES FOR ENERGY

An orange arrow pointing to the right, highlighting the second item in the outline.

2. CLIMATE SERVICES PROJECTS

SPECS: Seasonal-to-decadadal climate Prediction for the improvement of European Climate Services

IC3 role: Project coordinator

Call: FP7 Environment and Climate

Description: Deliver a new generation of European climate forecast systems, with improved forecast quality and efficient regionalisation tools.

Link to energy: IC3 and Vortex represent the renewable energy service provider and user group in the project.

Total budget: 11,989,174€

Timeframe: 2012-2016

EUPORIAS: EUropean Provision Of Regional Impact Assessment on a Seasonal-to-decadal timescale

IC3 role: Partner, WP leader and energy case study representative

Call: FP7 Environment and Climate

Description: Develop new technologies to exploit emerging capabilities from climate research. Engage with users to develop useful & usable tools.

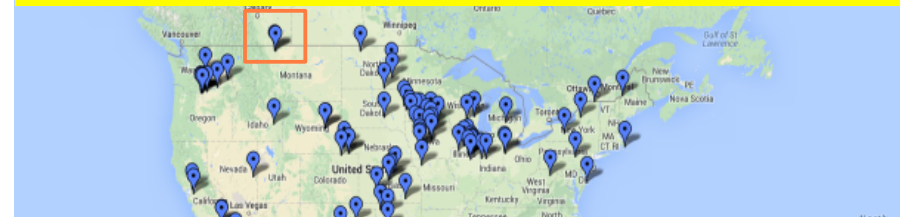
Link to energy: IC3 and EDF/Vortex represent the renewable energy service provider and user groups to develop semi-operational prototype for European wind forecasts over seasonal timescales.

Total budget: 12,962,917€

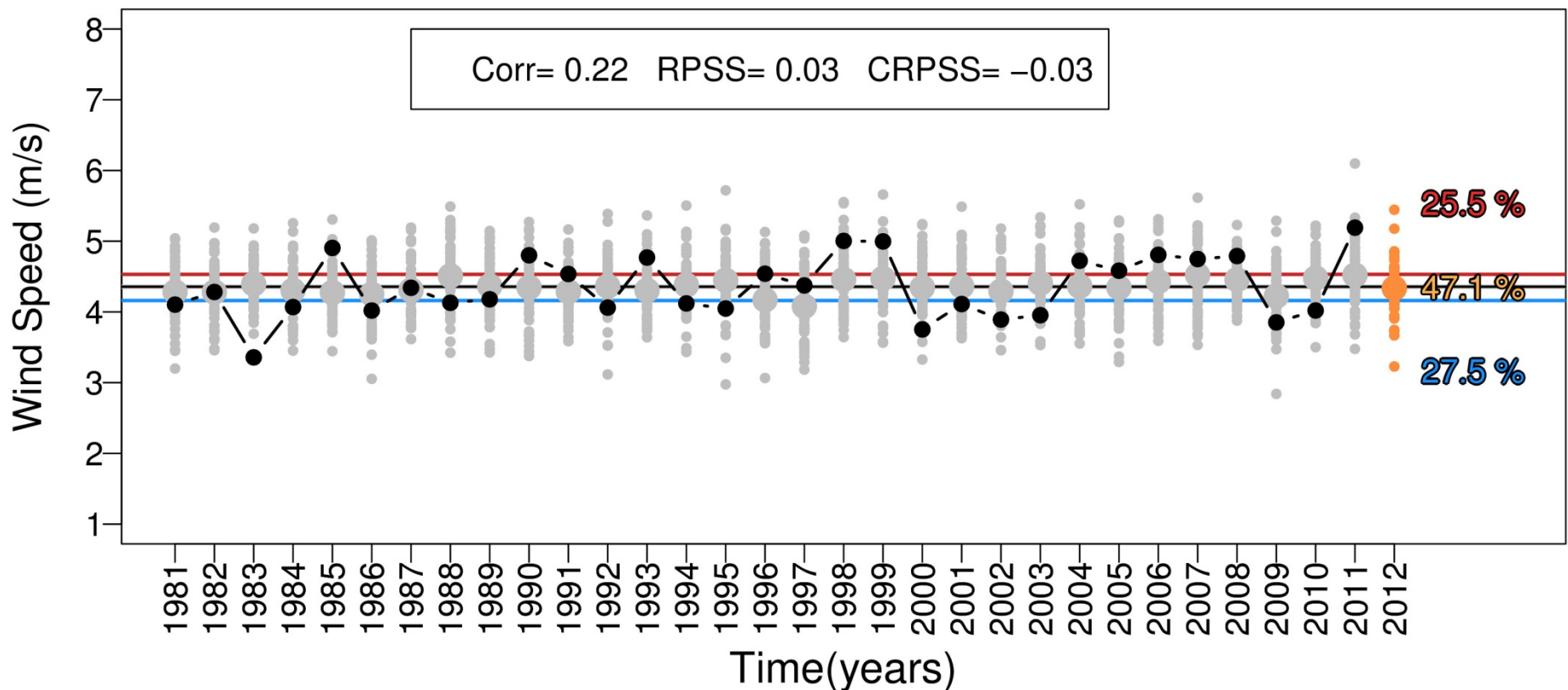
Timeframe: 2012-2016

Wind Speed Forecast

Climate model: ECMWF S4
10m wind speed "observations": ERA-Interim
Winter season forecast: 1 month lead time

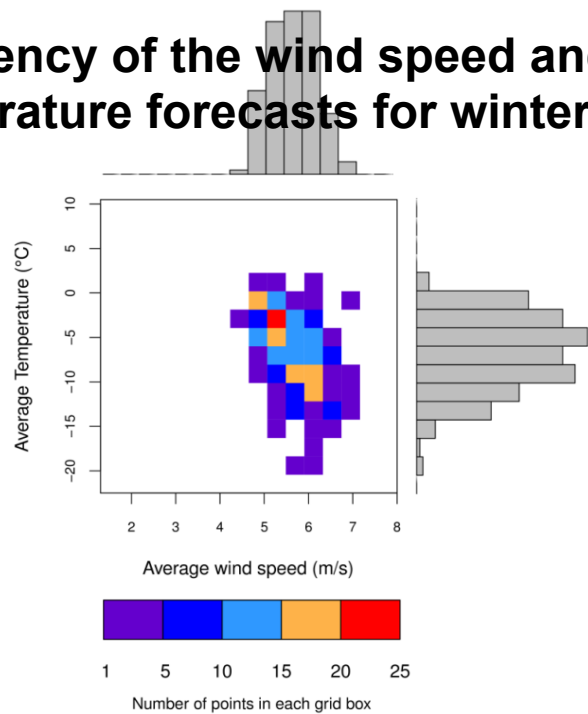


Simple bias correction

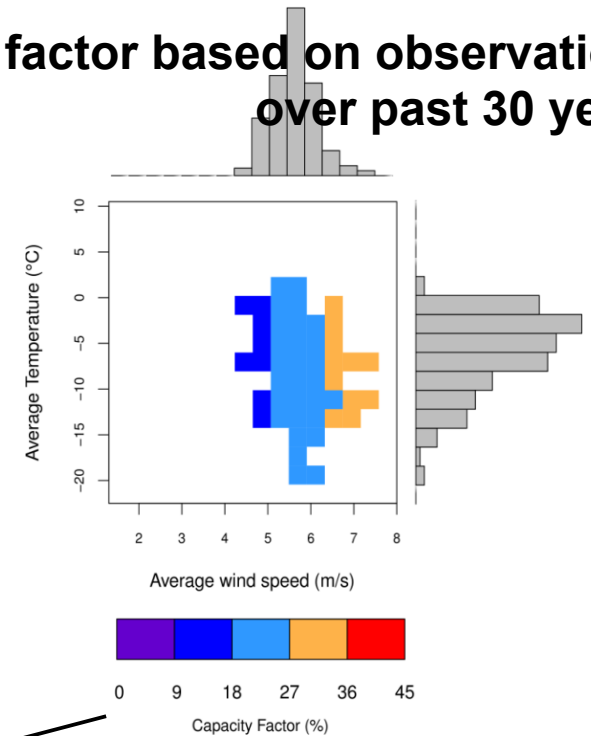


Translating Wind Forecasts into Power Capacity

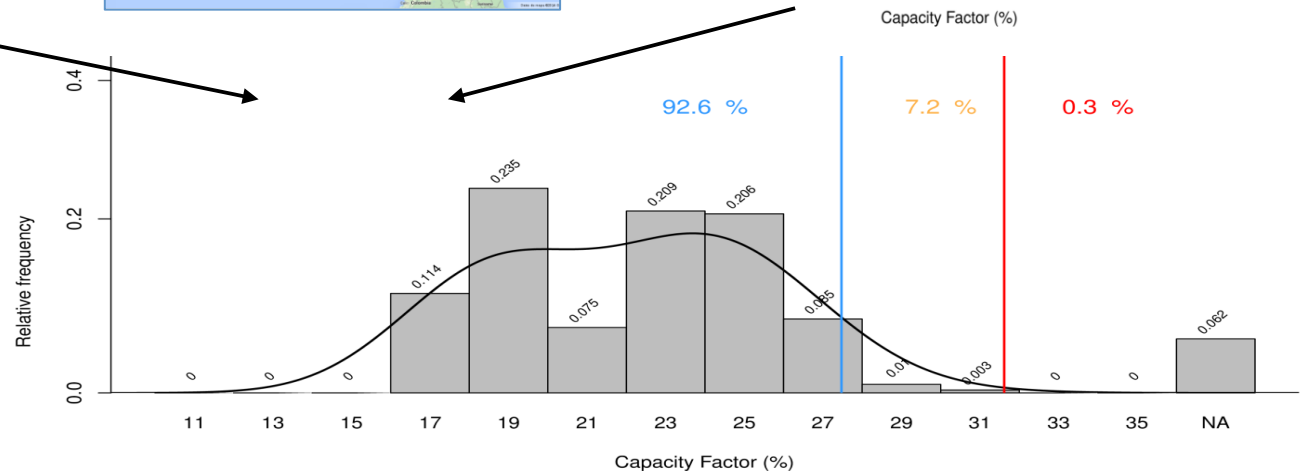
Frequency of the wind speed and temperature forecasts for winter season 2012



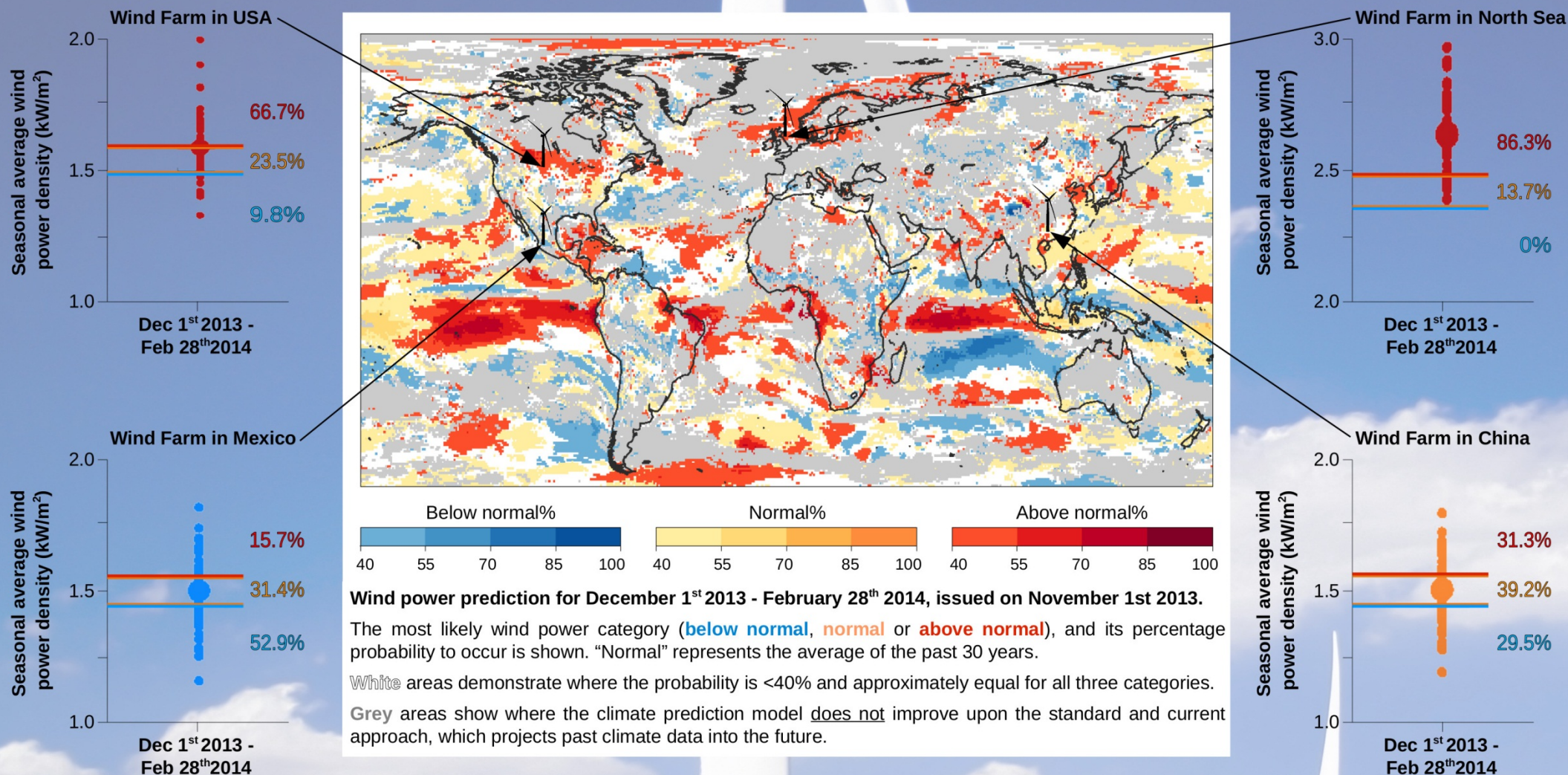
Capacity factor based on observations over past 30 years



Forecast of capacity factor for winter season 2012



Illustrative examples of seasonal wind power predictions



RESILIENCE: Strengthening the European Energy Network with Climate Services

IC3 role: Project leader

Call: National – Spanish Ministry of Industry

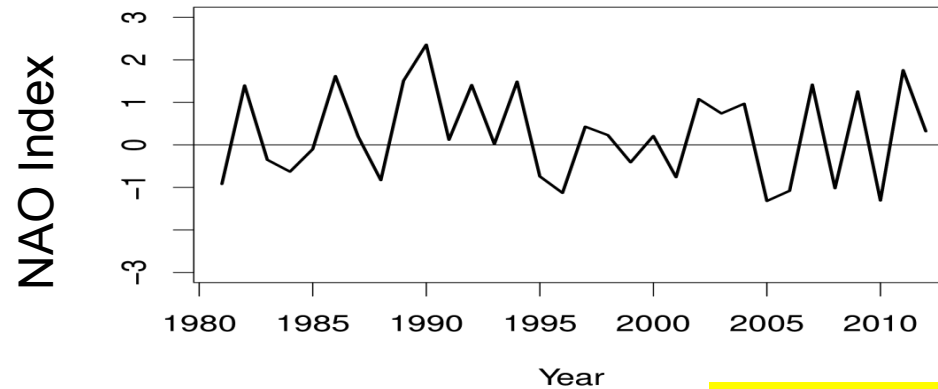
Description: Strengthen the efficiency and security of the European energy network using the state-of-the-art from subseasonal-to-seasonal climate predictions of wind power supply and temperature-related demand, developed in co-production with end users.

Link to energy: Special focus on the Iberian Peninsula and the North Sea region where wind power supply has significant impact.

Total budget: 224,000€

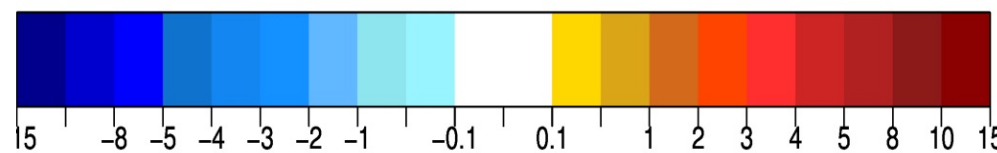
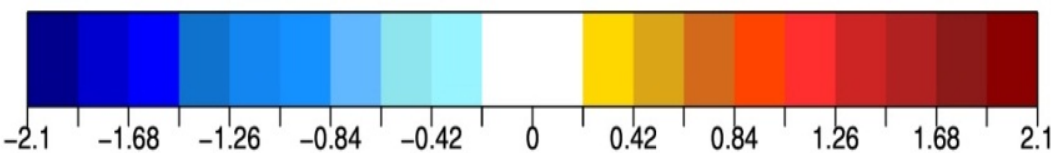
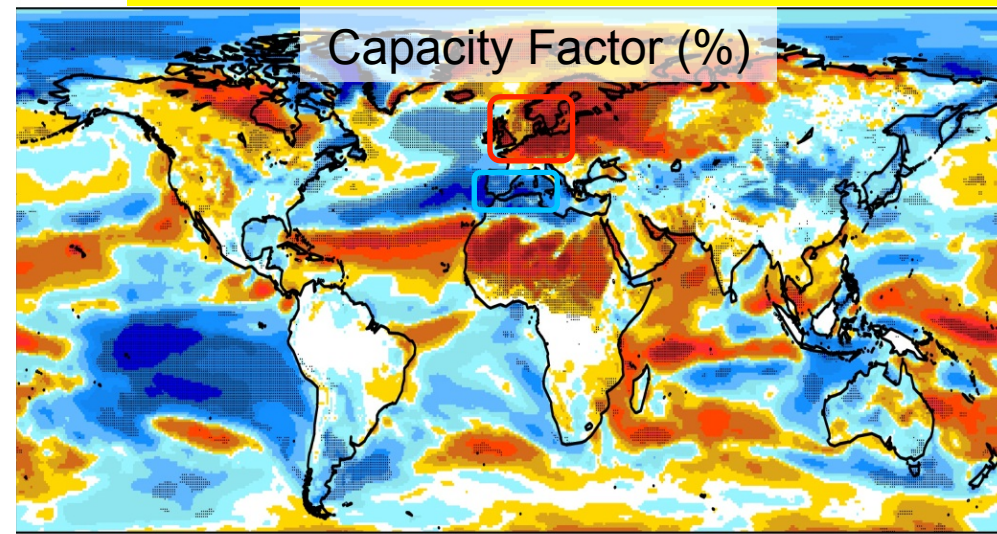
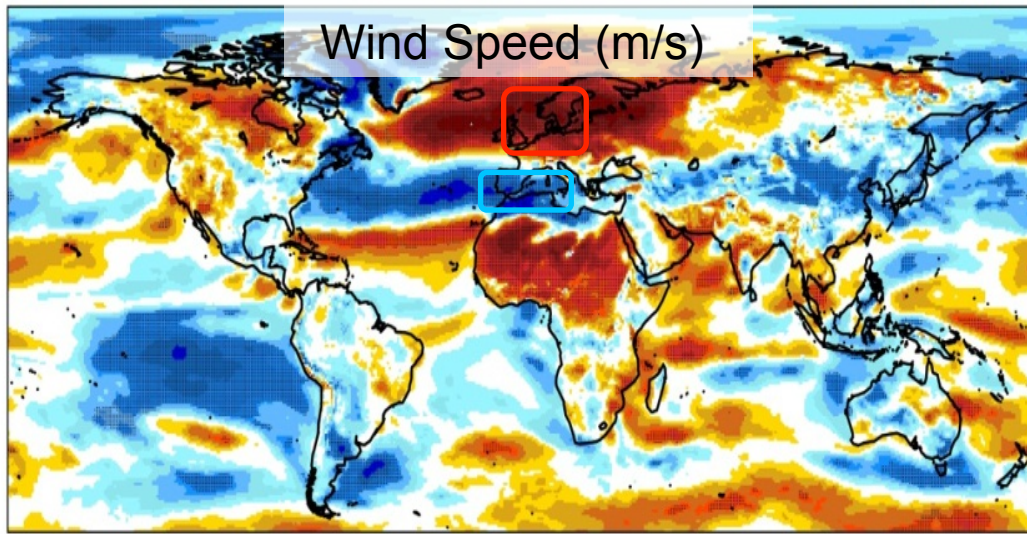
Timeframe: 2014-2016

Impact of NAO on Wind Speed and Capacity Factor



Differences with NAO + and NAO - conditions

10m wind speed “observations”: ERA-Interim
Boreal winter season period 1981-2012



FUTURE WORK:

NEWA: New European Wind Atlas

Description: New EU wind climate database to reduce the uncertainty of wind project discrepancies between calculated and actual production and operating conditions.

PRIMAVERA: PProcess-based climate sIMulation: AdVances in high-resolution modelling and European climate Risk Assessment

Description: To develop a new generation of advanced and well-evaluated high-resolution global climate models, capable of simulating and predicting regional climate with unprecedented fidelity, for the benefit of governments, business and society in general.

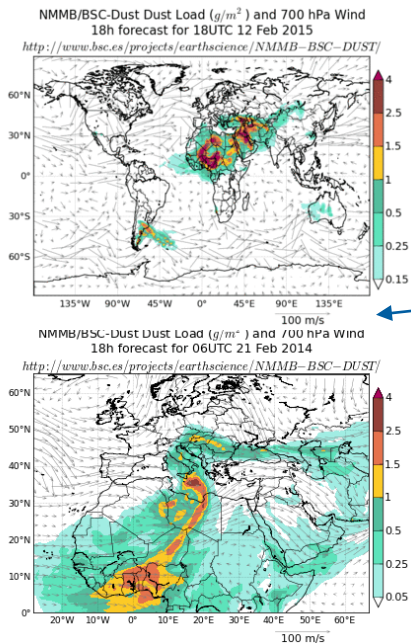
IMPRESX: IMproving PRedictions and management of hydrological EXtremes

Description: To improve forecast skill of meteorological and hydrological extremes in Europe and their impacts, by applying dynamic model ensembles, process studies, new data assimilation techniques and high resolution modeling.

SHORT TERM FORECAST SERVICES FOR THE ENERGY SECTOR.

Mineral dust modelling for solar energy management

BSC has developed in collaboration with NCEP the **NMMB/BSC-Dust model**

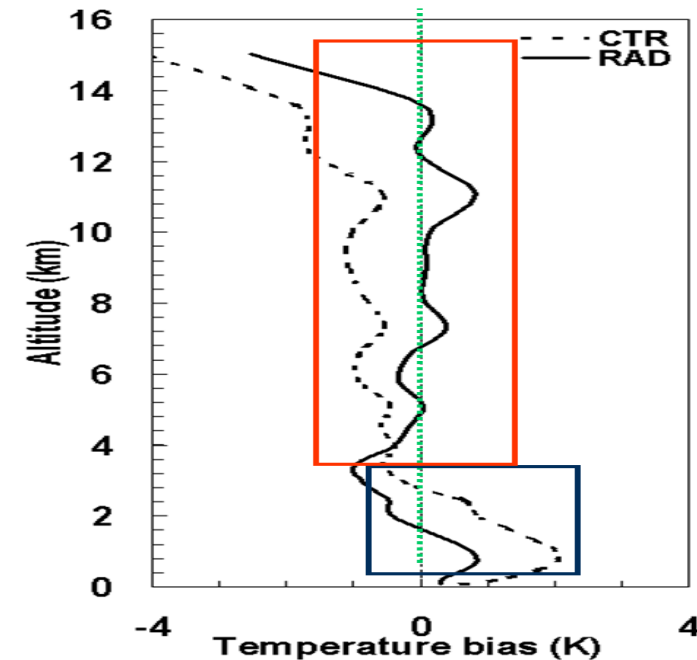


Forecast and
diagnostic mode

Regional and
global scales

On-line
feedbacks:
Dust-radiation
interaction

BIAS 13 April 2002 at 00UTC (24h forecast)



Services: Solar energy management

- Forecasts system to prevent energy loss and improve the management of solar power plants
- Geographical information to decide the location of future solar power plants



NEWA: New European Wind Atlas

IC3 role: Partner, Climate predictions representative

Call: FP7 Energy ERA-NET

Description: New EU wind climate database to reduce the uncertainty of wind project discrepancies between calculated and actual production and operating conditions.

Link to energy: Database to include: wind resources, including extremes; their probability of occurrence and associated uncertainty; guidelines and best practices; development of dynamical downscaling methodologies and open-source models validated through measurement campaigns.

Total budget: 13,054,038€

Timeframe: 2012-2016

Advancing Renewable Energy with Climate Services (ARECS)

Join the initiative at: www.arecs.org

- ✓ Monthly, seasonal and decadal wind and solar forecasts
- ✓ Provide feedback, register your needs
- ✓ Receive a quarterly, seasonal wind forecast newsletter

Website



Monthly to decadal probabilistic climate forecasts for safe and efficient energy management

Business Opportunities

Climate Variability and Risk

Wind Forecasts

Solar Forecasts

Decision Making Process

Publications

Newsletter

Glossary

MINIMISE UNCERTAINTY

Probabilistic climate forecasts predict the future variability and extremes in weather, to minimise uncertainty of renewable power supply and energy demand. Timescales of interest are from one month to decades.

MANAGE RISK

By understanding the expected variation of weather resources and its impact on the energy system, improved, proactive and anticipatory adaptation decisions can be made to better manage energy planning and operation risks.

OPTIMISE STRATEGIES

ARECS aims to stimulate the use of probabilistic climate forecasts to manage the future risk of renewable power supply and energy demand, by developing a full assessment of wind, solar and temperature predictability alongside tools to effectively analyse the forecasts.

How could wind power supply and energy demand vary next season?

It is currently unknown how wind, solar or temperature resources will vary from one season to the next. The ARECS newsletter aims to demonstrate how state-of-the-art climate forecasting could minimise the uncertainty of future resource variability, and guide decisions within the energy sector.

[Click here to view probabilistic forecast examples](#)

Could probabilistic forecasts be used to predict meteorological events in the past?

If your strategies were affected by a variability in climate conditions, please send us details of such events, so that we can assess how well our probabilistic forecasts could have predicted them. Information should include the reference month, season or year, the geographical area, and the observed meteorological conditions:

Newsletter



Issue 2: released February 2014

[View this email in your browser](#)

Wind Forecast for last spring 2013



Seasonal Forecasts for Wind Energy

How will wind power vary next season, and how could this affect you:

- Investment Cash Flow - Energy Trading - Insurance Derivatives -
- Operation & Maintenance Schedule - Energy Balance -

It is currently unknown how wind resources will vary from one season to the next, and the effect this could have on important planning and operational questions like those above.

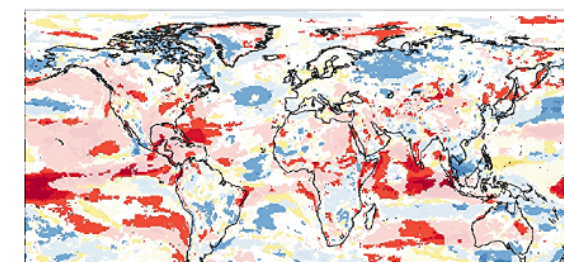
This quarterly newsletter issues seasonal wind forecasts from the same upcoming season, but in the previous year, and compares them to the observations of what actually happened.

The aim is to demonstrate how state-of-the-art climate forecasting could minimise the uncertainty of seasonal wind variability, and guide decisions within the wind energy sector.

To manage climate-related risks for a specific decision making process in the future, wind forecasts could be issued in real time via a climate service, for a given season and at a relevant spatial scales.

Probabilistic Spring 2013 Forecast of the Most Likely Wind Speed Category (above normal, normal or below normal)

This spring season forecast demonstrates wind information that could have been made available on February 1st 2013 for months March - May (inclusive) 2013.



Data represented:

Observed - 10m Wind Resource Anomalies (m/s): based on reanalysis data (ERA-Interim), not direct observations.

Forecast - 10m Wind Resource Anomalies (m/s): based on post processed ECMWF S4 forecast system data.

Coloured areas: forecast = observation.

Transparent areas: forecast ≠ observation.

Areas where the

Climate Forecasts: State-Of-The-Art Approach

Stage 1: Dynamical forecasts

- Initialisation of ensemble simulations

Stage 2: Post-processing

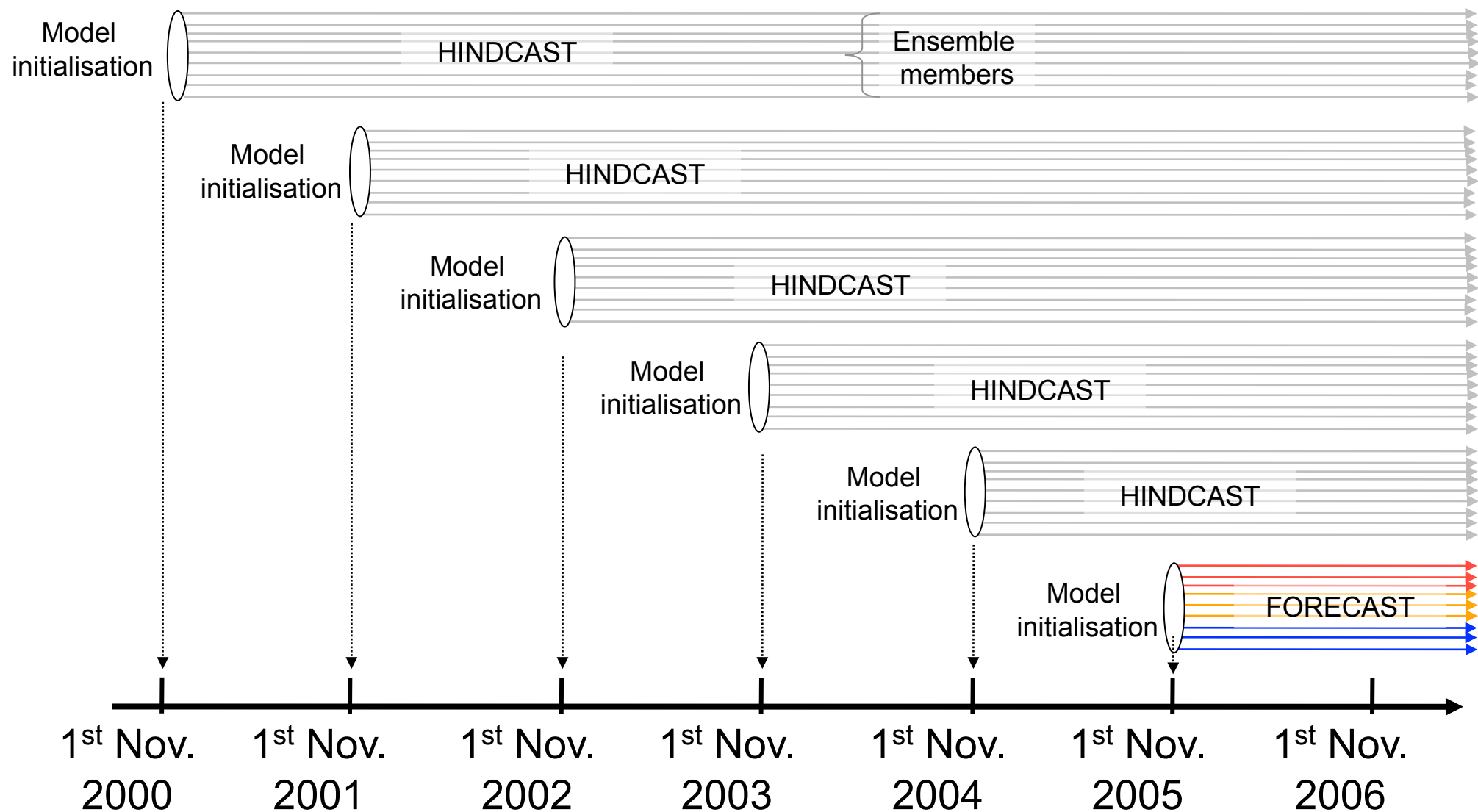
- Bias correction or calibration
- Combination: multi-model approach

Stage 3: Validation

- Verification: skill assessments

Stage 1: Dynamical forecasts

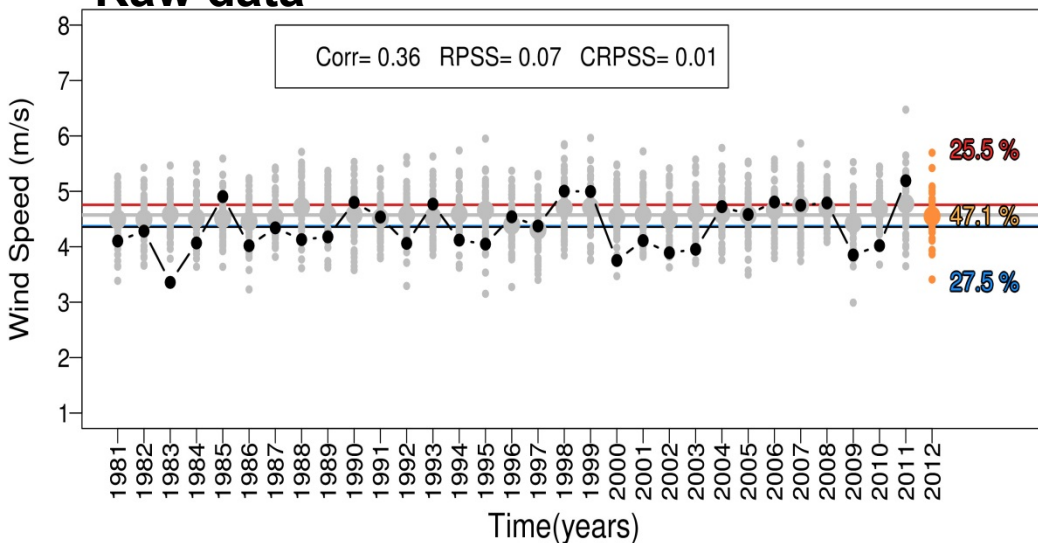
Initialisation of ensemble simulations



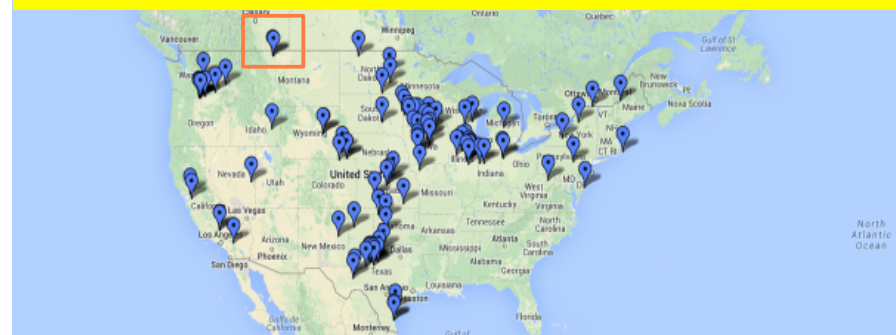
Stage 2: Post-processing

Bias correction or calibration

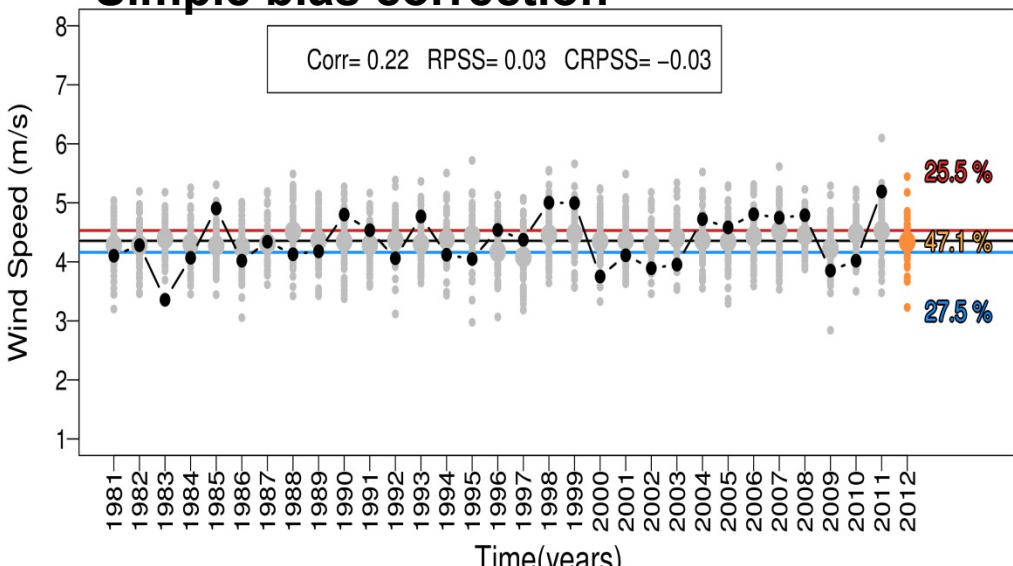
Raw data



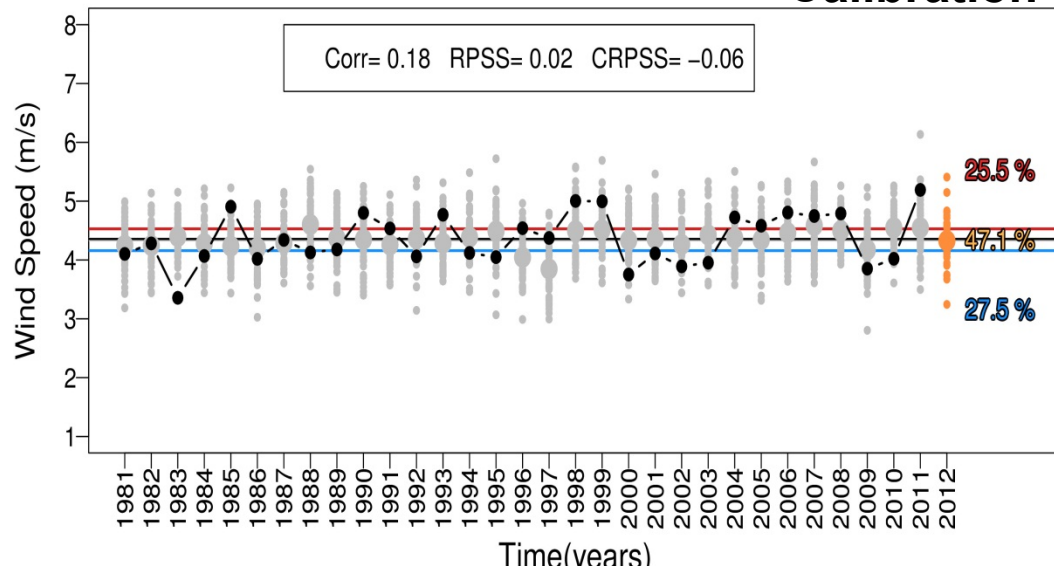
Climate model:ECMWF S4
10m wind speed “observations”: ERA-Interim
Winter season forecast: 1 month lead time



Simple bias correction



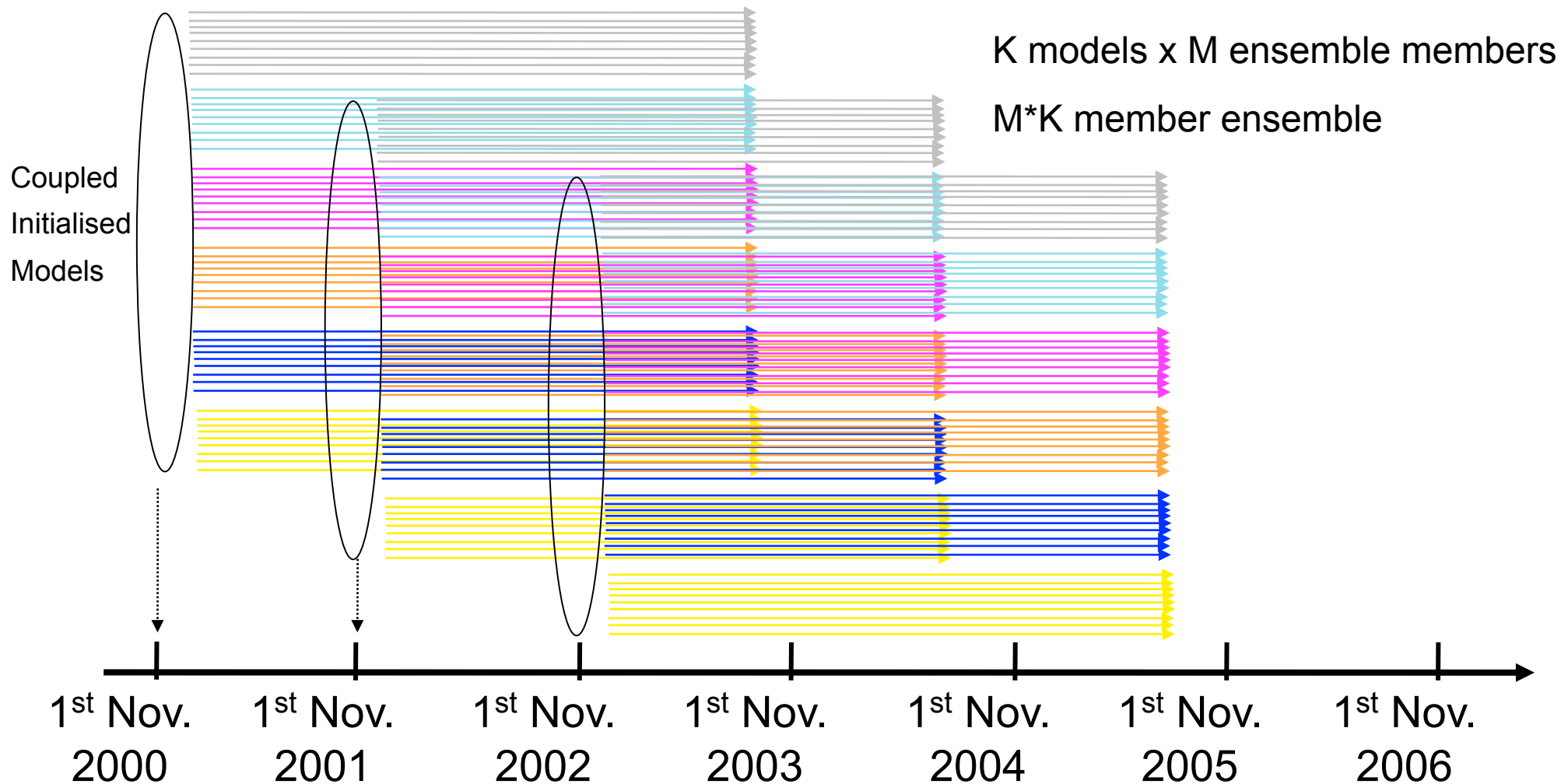
Calibration



Stage 2: Post-processing

Combination: multi-model approach

Model 1 Model 2 Model 3 Model 4 Model 5 Model 6



Stage 3: Validation

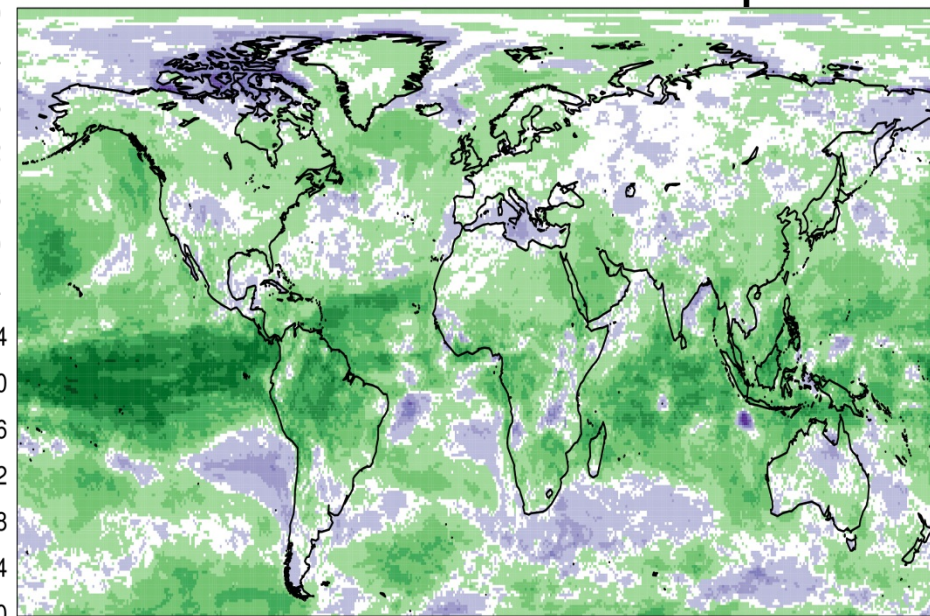
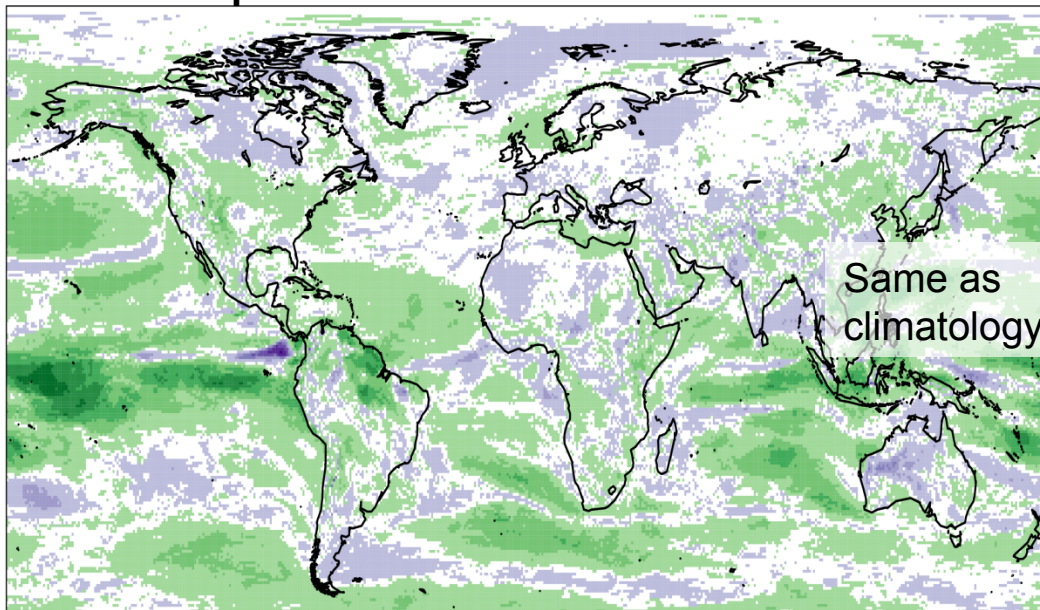
Verification: skill assessments

Climate model: ECMWF S4
 "Observations": ERA-Interim, past 30 years
 Winter season forecast: 1 month lead time

10m Wind Speed

Perfect forecast

Temperature



Worse than
climatology

FURTHER VALIDATION POSSIBLE BASED ON REAL MEASUREMENTS